Installation and Maintenance Manual

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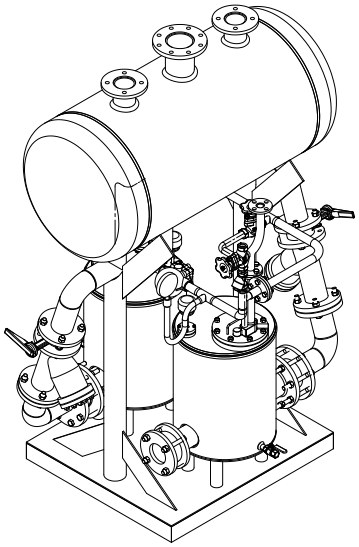
Duplex Pressure Powered Pump Package Unit with CRM485R and IJ

PPPPU-D



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PLEASE NOTE - Throughout this manual this cautionary symbol is used to describe a potential damage or injury that might occur if the safety considerations are overlooked. This symbol denotes CAUTION, WARNING or DANGER.

1. Preface:

This manual is intended for anyone using, commissioning, servicing, or disposing the below mentioned products safely and efficiently.

Duplex Pressure Powered Pump Package Unit with CRM485R and IJ (PPPPU-D),

Size: DN80 (3'')

PLEASE NOTE:

Throughout this manual the following cautionary symbol is used to describe a potential damage or injury that might occur if the safety considerations are overlooked.

2. Important Safety Notes:

Read this section carefully before installing/operating/maintaining the product. The precautions listed in this manual are provided for personnel and equipment safety. Furthermore, Forbes Marshall accepts no responsibility for accidents or damage occurring as a result of failure to observe these precautions. Note that the product is designed to perform for non-contaminated fluids only. A contamination in the form of chemical, foreign particle etc. can lead to problem with product performance and life of the product.

If these products in compliance with the operating instructions are, properly installed, commissioned, maintained and installed by qualified personnel (refer Section 2.7) the safety operations of these products can be guaranteed. General instructions for proper use of tools and safety of equipments, pipeline and plant construction must also be complied with.

2.1 Intended use:

Check if the product is suitable for intended use/ application by referring to the installation and maintenance instructions, name plates and technical information sheets.

i) The product is suitable for use as defined in the technical information sheet. In case the need arises to use the product on any other fluid please contact Forbes Marshall for assistance.

ii) Check for the suitability in conformance to the limiting conditions specified in technical information sheet of the product.

iii) The correct installation and direction of fluid flow has to be determined.

iv) Forbes Marshall products are not intended to resist external stresses, hence necessary precautions to be taken to minimize the same.

2.2 Accessibility and Lighting:

Safe accessibility and working conditions are to be ensured prior to working on the product.

2.3 Hazardous environment and media:

The product has to be protected from hazardous environment and check to ensure that no hazardous liquids or gases pass through the product.

2.4 Depressurizing of systems and normalizing of temperature:

Ensure isolation and safety venting of any pressure to the atmospheric pressure. Even if the pressure gauge indicates zero, do not make an assumption that the system has been depressurized.

To avoid danger of burns allow temperature to normalize after isolation.

2.5 Tools and consumables:

Ensure you have appropriate tools and / or consumables available before starting the work. Use of original Forbes Marshall replacement parts is recommended.

2.6 Protective clothing:

Consider for the requirement of any protective clothing for you/ or others in the vicinity for protection against hazards of temperature (high or low), chemicals, radiation, dangers to eyes and face, noise and falling objects.

2.7 Permits to work:

All work to be carried out under supervision of a competent person. Training should be imparted to operating personnel on correct usage of product as per Installation and Maintenance instruction. "Permit to work" to be complied with (wherever applicable), in case of absence of this system a responsible person should have complete information and knowledge on what work is going on and where required, arrange to have an assistant with his primary goal and responsibility being safety. "Warning Notices" should be posted wherever necessary.

2.8 Handling:

There is a risk of injury if heavy products are handled manually. Analyze the risk and use appropriate handling method by taking into consideration the task, individual, the working environment and the load.

2.9 Freezing:

Provision should be made to protect systems which are not self-draining, against frost damage (in environment where they may be exposed to temperatures below freezing point) to be made.

2.10 Returning products:

Customers and Stockist are reminded that, when returning products to Forbes Marshall they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk.

This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

3. Brief Product Information:

3.1 Description:

The Forbes Marshall Duplex Pressure Powered Pump Package Unit, PPPPU-D, is a duplex positive displacement pump unit operated by steam, compressed air or pressurized gas. The unit is specifically designed to pump hot condensate and liquids of specific gravity 1.0 down to 0.9.

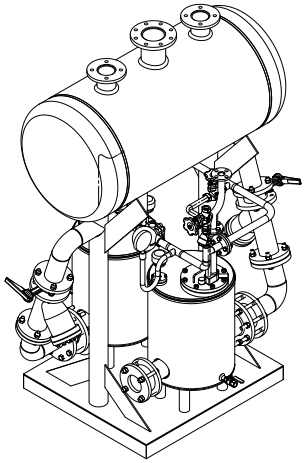


Figure 1: Duplex Pressure Powered Pump Package Unit

3.2 Sizes and End Connections:

Size DN 80

Model	Cond. Inlet (DN)	Cond. Outlet (DN)	Vent (DN)
PPPPU-D	80	50	80

Condensate inlet : vent flanged to ANSI Class 150
Condensate outlet : use flange provided with PPPPU-D

3.3 Limiting Conditions:

PMA Maximum design pressure	8.7 bar g
TMA Maximum design temperature	220°C
Operating inlet motive pressure	Steam / compressed air /pressurised gas 3-7 bar g (max.)
Pump discharge per cycle	30 kg
Steam consumption	3 kg of steam per 1000 kg condensate pumped
Air consumption	22 SCF per 1000 Kg condensate pumped
Minimum operating temperature	0°C

Note: For lower operating temperatures consult Forbes Marshall

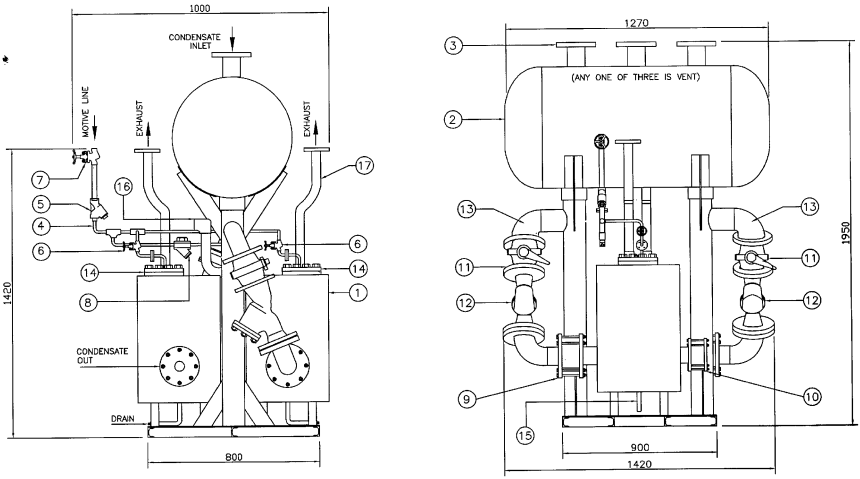


Figure 2: Detail of Duplex Pressure Powered Pump Package Unit

Sr. No.	Part	Material	Standard
1	Shell assembly	Carbon steel	
2	Receiver assembly	Carbon steel	IS 3589 Class C
3	Vent connection DN 80 flanged ANSI 150	Carbon steel	
4	Steam inlet line	Carbon steel	IS1239 Class C
5	DN 20 Strainer	Cast iron	IS 210 FG 260
6	DN 15 Piston valve	Carbon steel	
7	DN 20 Piston valve	Carbon steel	
8	DN 20 FMTD64 trap	SS	
9	DN 80 Check valve	SS	
10	DN 50 check valve assembly for cond. outlet line		SS
11	DN 80 butterfly valve flangedASA 150	SG iron	
12	DN 80 Strainer	Cast iron	IS 210 RG 260
13	Condensate inlet	Carbon steel	IS 1239 ClassC
14	Cover plate assembly	Cast steel	
15	Drain	Carbon steel	IS1239 Class C
16	Overflow line	Carbon steel	IS 1239 Class C
17	Exhaust line	Carbon steel	IS 1239 Class C

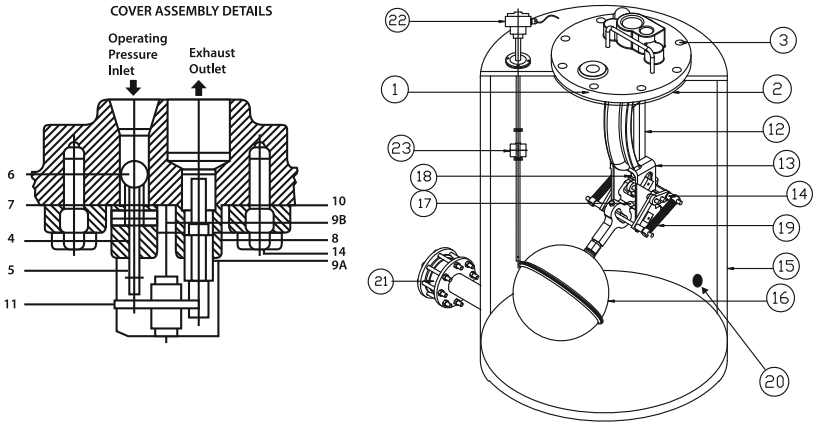
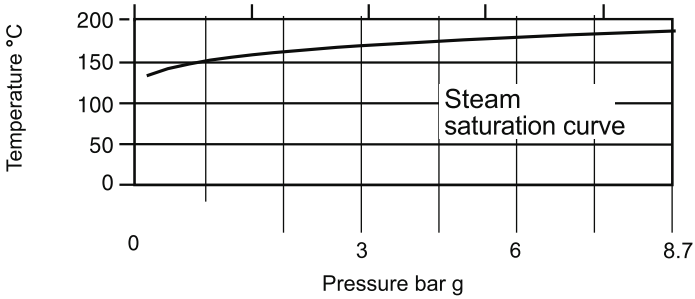


Figure 3: Mechanism detail of PPPPU-D

Material:

Sr. No.	Description	Material	Standard
1	Cover	Cast Iron	IS 210 Gr FG 260
2	Cover Gasket	Synthetic Fibre	-
3	Stud and Nut M - 12	Cast Steel	-
4	Inlet Valve Seat	Stainless Steel Type 304	ASTM A 276
5	Inlet Valve Stem	Stainless Steel Type 304	ASTM A 276
6	Inlet Valve Head	Stainless Steel	-
7	Inlet Seat Gasket	Copper	-
8	Exhaust Valve	Stainless Steel Type 304	ASTM A 276
9(a)	Exhaust Valve	Stainless Steel Type 304	ASTM A 276
9(b)	Exhaust Valve Head	Stainless Steel Type 304	ASTM A 276
10	Exhaust Seat Gasket	Copper	-
11	Valve Actuator Disc	Stainless Steel Type 304	ASTM A 276
12	Push Rod	Stainless Steel Type 304	ASTM A 240
13	Mechanism	Cast Iron	IS 210 FG 260
14	Mechanism Studs M12	Stainless Steel	IS 1364
15	Body	Cast Steel	IS 2062
16	Float	Stainless Steel Type 304	ASTM A 240
17	Linage Mechanism	Stainless Steel	ASTM A 351 CF 8
18	Push Rod Actuator	Stainless Steel	ASTM A 351 CF 8
19	Spring	Inconel	-
20	Plug 1/2"BSPT	Forged Carbon Steel	ASTM A 105
21	Check Valve	Stainless Steel	-
22	Flow-temp Sensor	Stainless Steel	-
23	Sensor Float	Stainless Steel Type 304	ASTM A 240

3.4 Operating Range:



3.5 Standard Accessories:

Condensate recovery meter - 485 (CRM485R)

Insulation Jacket (IJ-PPPPU-D)

3.6 How to Select and Size:

From the inlet pressure, back pressure and filling head conditions given below select the pump size which meets the capacity requirements of the applications.

Select optional extras as required.

Back pressure is the lift height (H) in mts x 0.1 plus bar (g) in return line plus downstream piping friction pressure drop in bar (g) at the lesser of six times the actual flow rate or 340 lit / min

3.7 Capacity of each pump (kg/hr):

When installed with recommended filling head above top of pump: 305 mm. For liquid specific gravity (0.9 to 1).

MOTIVE STEAM		
Pressure (bar g)		Capacity
Motive	Back	(Kg/hr)
8.7	0	20710
	1	12330
	2	10180
	3	7850
	4	6990
8	0	20490
	1	11660
	2	9110
	3	7540
	4	5900
7	0	20270
	1	11090
	2	8880
	3	7030
	4	5710
6	0	19760
	1	10420
	2	8580
	3	6850
	4	5440
5	0	19210
	1	10100
	2	8280
	3	6140
4	0	18350
	0.5	10880
	1	8920
	2	6430
3	0	16180
	0.5	9410
	1	7350

MOTIVE AIR		
Pressure (bar g)		Capacity
Motive	Back	(Kg/hr)
6	0	19290
	1	15850
	2	13420
	3	11530
	4	9620
5	0	19210
	1	15400
	2	12920
	3	10930
4	0	19110
	0.5	16850
	1	15100
	2	12210
3	0	19000
	0.5	16170
	1	14170

3.8 Capacity Multiplying Factors for Other Filling Heads:

Filling Head mm	DN 80
152	0.84
305	10
610	1.08
914	1.20

Capacity multiplying factors for motive gas supplies (other than steam)
% Back Pressure VS Motive Pressure (BP / MP)

10%	20%	30%	40%	50%	60%	70%	80%	90%
1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28

3.9 Example:

Condensate Load	6000kg/hr
Steam/Air pressure available for operating pump	5.0 Bar g
Vertical lift from pump to return piping	9 m
Pressure in return piping (piping friction negligible)	1.72 Bar g
Filling head on pump	0.3048 mtr.

Solution:

1. In duplex unit condensate load on each pump =3000kg/hr
2. Calculate 'h', the total lift or back pressure against which the condensate must be pumped
   =(9mx0.1)+1.72
   =2.62 bar g
3. From capacity table with 5.0 bar g operating Inlet pressure and 3.0 bar g back pressure, each pump has capacity of 3070 kg/hr
4. From this, the duplex unit handles condensate load 6140 kg/hr for given operating conditions.

Note from capacity factor charts:

Pump capacity if filling head is 0.610 mtr.
=1.2 x1725 =2070 kg /hr

4. Product Working Principle :

Note: For this section refer to Figure 2

A PPPPU-D unit consists of a receiver**(2)**, Inlet Isolation valve**(11)**, Strainer**(12)**, a body shell**(1)** containing a float mechanism which operates a set of motive steam / air inlet **(4)** and exhaust line **(17)** and check valves inlet **(9)** & outlet**(10)**. The steam or air is used as motive media to operate the pump. Condensate comes into the pump receiver **(2)** from Flash Vessel or plant condensate header and is allowed to flow in to the pump body **(1)** having float mechanism by opening the inlet isolation valve **(11)**.

Note: For this section refer to Figure 3

In the normal position before startup the float is at the lowest position with the motive steam/air valve **(5)** closed and, the exhaust valve open **(9A)**. When condensate flows by gravity through inlet check valve in to pump body **(15)**, the float **(16)** will rise along with the level of condensate.

As the float **(16)** continues to rise, the mechanism link **(17)** is engaged which increases tension in the springs **(19)**. When the float **(16)** has risen to its upper tripping position, the linkage mechanism **(17)** snaps upward over center. The energy in the springs **(19)** is released as the push rod **(18)** is moved upward, to simultaneously open the motive steam inlet valve **(5)** and close the exhaust valve **(9A)**. Steam flow through the inlet valve **(5)** increases the pressure within the body and closes the inlet check valve. The increased pressure in the body shell **(15)** exceeds the back pressure in the condensate discharge line, and opens the discharge check valve **(21)** to pump out the condensate in the discharge line.

As the condensate level in the pump body **(15)** falls, the float **(16)** is lowered and mechanism link **(17)** is engaged, which again increases the tension in the springs **(19)**. When the float **(16)** reaches the lower tripping position, the linkage mechanism **(17)** snaps downward over center. The energy in the springs **(19)** is released as the push rod **(18)** is moved downward, to simultaneously open the exhaust valve **(9A)** and close the steam inlet valve **(5).** Steam / air utilized for pumping the condensate gets released to through exhaust valve and this completes one pumping stroke.

When the pressure in the pump body **(15)** has fallen below the pressure in the inlet pipe, the inlet check valve opens. Condensate will again flow through the check valve to fill the body and begin next cycle.

5. Installation Guidelines :

Note: Before implementing any installations observe the 'Important Safety notes" in section 2. Referring to the Installation and Maintenance Instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended installation.

Note: For this section refer to Figure 4

1. Ensure that there is no damage in transit. Before installation is done ensure that all steam, air or gas lines are closed. Select correct pipeline sizes as per the pump and connections are available. Level the unit by level bottle.
2. The reservoir has 3 ports, two of them should be connected for condensate inlet **(A)** and third is used for vent line **©**. Most important is that reservoir must be vented to atmosphere. This is to ensure free flow of condensate under gravity to the pump.
3. It is recommended to install PPPPU along with a Forbes Marshall Flash vessel arrangement, if condensate flashing is expected when exposed to atmosphere.
4. Connect the condensate line coming from plant to the flash vessel inlet port. Install strainer (1), single orifice float trap **(2)** and view glass **(3)** after the flash vessel and connect condensate outlet line to the pump receiver (6). Install the safety relief valve **(4)** and pressure gauge **(5)** at respective locations provided on the flash vessel. Ensure that the pump receiver inlet is at a lower level than the condensate outlet line of flash vessel so the condensate travels by gravity to the pump receiver.
5. Vent line **(C)** should be piped, unrestricted to safe location in the atmosphere.
6. Connect the motive steam or compressed airline **(7)** to the motive supply inlet .
7. A pressure gauge **(8)** is supplied loose along with the pump. Install the same on motive line syphon. Condensate discharge line **(B)** of pump should be routed to the boiler feed water tank and connect the same to the condensate nozzle of de-aerator head.

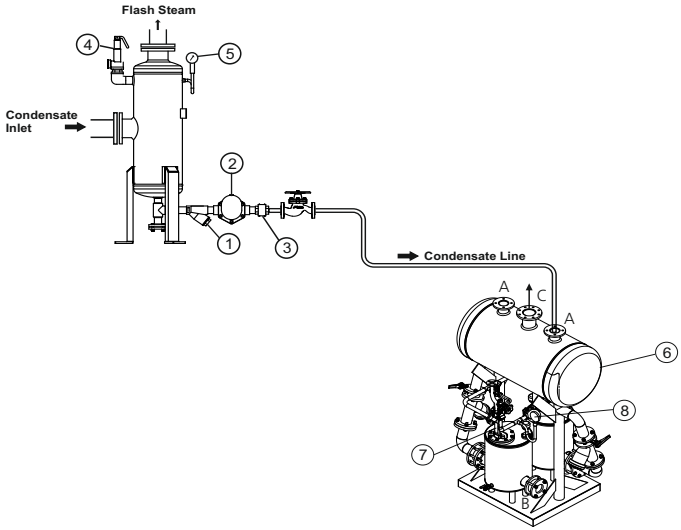


Figure 4: Installation of FM Flash Vessel and PPPPU-D

5.1 Care to be taken while routing the condensate pump discharge line : (Refer to Fig. 5)

1. The line size should be equal to or more than pump outlet flange size provided with pump.
2. As far as possible, the discharge line should have minimum bends. Ideally the condensate pump discharge line should be lifted immediately after the pump to the maximum elevation in the circuit and then to be connected to feed water tank with a downward slope. This ensures minimum backpressure on the pump.

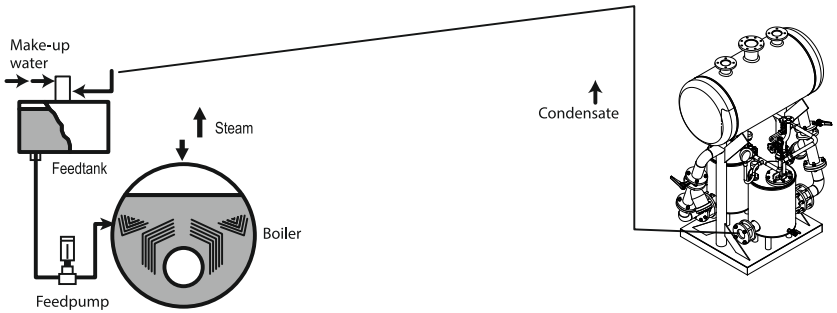


Figure 5: Routing the condensate line to the Feed Water Tank

5.2 In case more than one condensate pump is connected to a common Condensate line: (Refer to Figure 6)

1. Make sure that NRV supplied with pump is installed with flow direction towards FWT.
2. If more than one-pump discharge lines are to be connected to a common condensate line, please ensure that the individual line is connected from the top with a non-return valve. The common condensate line should be sized to take care of connected condensate load of all the pumps.

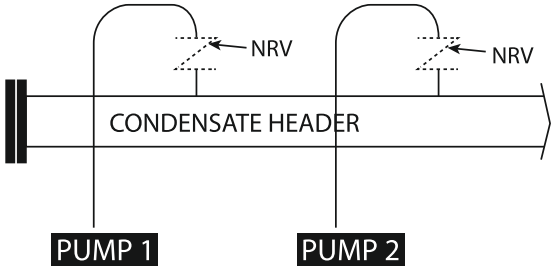


Figure 6: More than one pump connected to common condensate line

6. Startup and Commissioning:

It is recommended to install Forbes Marshall PPPPU-D along with a FM Flash Vessel arrangement, for all condensate pressure higher than atmosphere pressure. For trouble free operation of Duplex Pressure Powered Pump Package Unit, it is important that the single orifice float trap internals, pump internals & check valves are not subjected to dirt or other hard particles.

Therefore, prior to bringing the Duplex Pressure Powered Pump Package Unit in to operation, please ensure that the entire condensate piping circuit is thoroughly flushed.

6.1 Flushing Procedure in the presence of a Forbes Marshall Flash Vessel : (Refer Fig. 7)

1. Open the Forbes Marshall Flash Vessel drain line and allow the process condensate to flow through the drain till all the foreign particles & contaminated condensate is flushed out and we see clean condensate coming out.

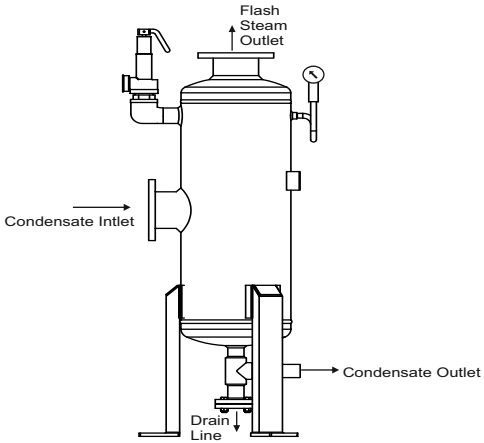


Figure 7: Flushing procedure of Forbes Marshall Flash Vessel

6.2 Flushing Procedure in the absence of a Forbes Marshall Flash Vessel : (Refer Fig. 2)

1. Wherever process condensate is directly connected to pump receiver & FM Flash Vessel module is not part of Duplex Pressure Powered Pump Package Unit, open the pump condensate strainer cap **(5)** & screen to flush the foreign particles and contaminated condensate. Similarly, motive steam / airline **(4)** should also be flushed by removing strainer cap & screen until we see clean motive media coming out.
2. Once flushing of condensate and motive line is completed, open the motive line isolation valve **(7)** and ensure that the motive media pressure should not exceed as mentioned on the pump nameplate.
3. Make sure that the motive line drain trap **(8)** is operational.
4. Open the pump condensate isolation valve **(11)** and allow the condensate to flow to the pump receiver **(2)** and subsequently to pumping chamber **(1).**
5. Now the pump shall operate as described in section 4.
6. Steam or air utilized for pumping is released with an audible exhaust at the end of each pumping cycle. Observe the condensate return line pressure & ensure that the motive pressure is at least 1.5 to 2 bar g more than the back pressure.

7. Maintenance Guidelines:

Before undertaking any maintenance on the product it must be isolated from both supply line and return line and any pressure should be allowed to safely normalize to atmosphere. The product should then be allowed to cool. With suitable isolation repairs can be carried out with the product in the line.

PPPPU-D units are designed for trouble free operation. In normal course of action maintenance is not required provided certain care of the system is taken.

7.1 Routine and Preventive Maintenance:

Please refer to the maintenance schedule mentioned in the table below to undertake routine maintenance of the Duplex Pressure Powered Pump Package Unit.

NO.	PARAMETERS TO BE CHECKED	FREQUENCY FOR CHECKING VARIOUS PARAMETERS					
A	Duplex Pressure Powered Pump Package Unit / Forbes Marshall Flash Vessel	Daily	Weekly	Monthly	Quarterly	Half Yearly	Annually.
1	Clean strainer of motive media line			Y			
2	Clean condensate inlet strainer			Y			
3	Visual inspection and cleaning of complete set of internals				Y		
4	Condensate pump chamber draining				Y		
5	Inlet / Exhaust valve leakage testing				Y		
6	DCV Cleaning					Y	
7	Operate motive line valve			Y			
8	Operate Condensate inlet valve			Y			
9	Lubrication of piston valves				Y		
10	Pr. Gauge calibration						Y
11	Checking of PPPPU-D motive pressure	Y					
12	Checking of flash steam pressure in Flash Vessel	Y					
13	Cleaning of motive line trap internals				Y		
14	Cleaning of steam trap internals				Y		
15	Visual inspection for leakages		Y				
16	Arresting leaks		Y				
17	Checking of float trap SLR setting				Y		
18	Cleaning of strainer between Forbes Marshall Flash Vessel and pump			Y			
19	Check air quality(in case motive media is air)		Y				
20	Visual inspection of Safety relief valve		Y				
21	Overhauling and cleaning of safety relief valve						Y

7.2 Tool Kit:

To carry out any maintenance of the PPPPU-D use the tools mentioned in the table below.

Size	Part	Component	Tool used and Size
DN 80	Internal Mechanism Assembly	Motive inlet and exhaust Valve	Open Spanner 26 mm (A/F)
		Float Mechanism	Open Spanner 19 mm (A/F)
		Push Rod and Lock Nut	Open Spanner 17 mm (A/F)
		Bush assembly and stop bolt	Box Spanner 13 mm (A/F)
		Stopper bracket bolt	Box spanner 8 mm (A/F)
		Float Arm Bolt	Open Spanner 10 mm (A/F)
		For Split Pin Assembly	Nose Plier
DN 80	External Assembly	Read switch assembly 4 No M6 studs; M6 X 4mm nuts	Ring spanner 10 mm (A/F)
		Internal assembly cover (M12 X 50)	Open spanner 18 / 19 mm (A/F)
		Motive inlet and exhaust hose pipe connection	Pipe wrench
DN 80	Condensate inlet connection	Butterfly valve (M16 X 120mm)	Box spanner 24 mm (A/F)
		Strainer assembly (M16 X 70mm)	Box spanner 24 mm(A/F)
		Disc check valve (M16 X 130mm)	Box spanner 24 mm (A/F)
	Condensate return connection	Disc check valve (M16 X 130mm)	Box spanner 24 mm (A/F)

7.3 Maintenance/Replacement Procedure :(Refer to Figure 3)

For a detailed maintenance/replacement procedure of the pump body internals, please refer to the instructions given in the subsequent sections;

7.3.1 Procedure to Maintain/Replace the whole PPPPU-D internal assembly:

1. Before carrying out any maintenance, remove all the connections to the pump cover **(1)**. Isolate the pump body by closing the inlet isolation butterfly valve.
2. Unscrew all eight nuts **(3)** present on the cover **(1)** and lift the cover and internal mechanism assembly from the pump body **(15)**.
3. Remove the assembly nuts to free the whole assembly from the cover.
4. Remove the old gasket **(2)**, and clean the gasket area. If required replace with a new one.
5. Insert the whole assembly back inside the pump body **(15)**.
6. Tighten the cover nuts **(3)**.

7.3.2 Procedure to Maintain/Replace float assembly:

1. Before carrying out any maintenance, remove all the connections to the pump cover **(1)**. Isolate the pump body by closing the inlet isolation butterfly valve.
2. Unscrew all eight nuts **(3)** present on the cover **(1)** and lift the cover and internal mechanism assembly from the pump body **(15)**.
3. Arrange the whole assembly onto the vice such that the internals are placed on top and clamp the cover.
4. Unscrew the float **(16)** from the float arm using appropriate spanner.
5. Screw the new float using Loctite 272 adhesive onto the threads.
6. Insert the whole assembly inside the pump body and screw the nuts.

7.3.3 Procedure to Maintain/Replace Exhaust valve seat and head assembly:

1. Unscrew all eight nuts **(3)** present on the cover **(1)** and lift the cover and mechanism assembly from the pump body **(15)**.
2. Arrange the whole assembly onto the vice such that the internals are placed on top and clamp the cover.
3. Remove the assembly nuts to free the whole assembly from the cover.
4. If required, remove the old gasket **(2)**, and clean the gasket area before replacing with a new one.
5. Unscrew the Exhaust valve head **(9B)**.
6. Clean the metal gasket and replace if required.
7. Fit the exhaust valve head and seat.
8. Now fit the PPPPU-D internal assembly onto the cover. Carefully engage the exhaust valve onto the actuator disc **(11)** and screw the nuts.
9. Unclamp the cover and insert the whole assembly back inside the pump body. While reinstalling the cover.
10. Tighten the cover nuts **(3)**.

7.3.4 Procedure to Maintain/Replace Inlet valve seat and head assembly:

1. Follow steps 1 through to 4 of section 7.3.3
2. Unscrew the Inlet valve head **(6)**.
3. Clean the metal gasket and replace if required.
4. Fit the inlet valve head and seat.
5. Now fit the PPPPU-D internal assembly onto the cover **(1)**. Carefully engage the exhaust valve **(9A)** onto the actuator disc **(11)** and screw the nuts.
6. Unclamp the cover and insert the whole assembly back inside the pump body **(15)**. While reinstalling the cover.
7. Tighten the cover nuts **(3)**.

7.3.5 Procedure to Maintain/Replace the springs:

1. Unscrew all eight nuts **(3)** present on the cover **(1)** and lift the cover and mechanism assembly from the pump body **(15)**.
2. Arrange the whole assembly onto the vice such that the internals are placed on top and clamp the cover.
3. Remove the split pins.
4. Remove the washer and the springs **(19)** from the linkage mechanism **(17)**
5. Clean the springs **(19)** and replace if required.
6. Put the washer and split pins back
7. Insert the whole assembly back inside the pump body **(15)**.
8. Tighten the cover nuts **(3)**.

8. Troubleshooting:

If the expected performance is unachievable after the installation of the Duplex Pressure Powered Pump Package Unit , check the following points for appropriate corrective measures.

Failure Mode	Possible Cause	Remedy
Pump stops working	a) Motive steam supply closed.	a) Open valves to supply motive steam pressure to condensate in the pump shell.
	b) Motive line strainer chocked.	b) Clean the strainer.
	c) Condensate inlet line closed	c) Open condensate inlet valve and allow condensate to flow in pumping chamber.
	d) Condensate line strainer chocked	d) Clean the strainer.
	e) Condensate discharge line closed	e) Open all discharge line valves to allow free discharge from pump to destination.
	f) Motive pressure insufficient to overcome back pressure	f) Check motive and back pressure. Adjust motive pressure to 2barg more than total back pressure.
	g) Float punctured	g) Replace the float.
	h) Check the direction of the Check Valve	h) Correct it if found wrong.
	i) Steam coming out continuously from exhaust line	i) It means motive steam inlet valve is leaking- open the internals and clean the inlet valve. Replace it if found damaged.
	j) Exhaust valve leaking	j) Open the pump internals and clean it. Also check the setting of valve actuator disc and correct it if found disturbed.

Failure Mode	Possible Cause	Remedy
Pump working, overflows only during discharge.	a) Check inlet Check Valve	a) Lap the seat and if the problem persists replace Check Valve
Pump working, continuously overflows	a) Pump under sized	a) Verify the rated capacity as per the capacity table. Install additional pump as required.
	b) Inlet strainer partially choked	b) Clean the strainer. Ensure all valves are fully open.
	c) Motive line strainer partially choked.	c) Clean the strainer and ensure inlet valve is fully open.
	d) Live steam reaching in pump receiver and receiver is pressurized.	d) Check the steam trap installed after the Flash Vessel or process traps (if there is no Flash Vessel), for leakage and rectify it.
	e) Receiver vent line is closed.	e) Make sure that receiver is vented to atmosphere as recommended.
	f) Insufficient motive pressure to achieve rated capacity.	f) Check motive pressure setting and maximum back pressure during operation. Compare with capacity table and increase motive pressure as required.
	g) Outlet check valve stuck open or leaking	g) Open the check valve and clean it or replace it if found damaged.
	h) Motive isolation valve partially closed.	h) Check and ensure that motive isolation valve is fully open.
	i) Condensate return line size lesser than pump discharge.	i) Condensate return line size should be equal to or greater than pump discharge line.

9. Available Spares : (Refer to Figure 8)

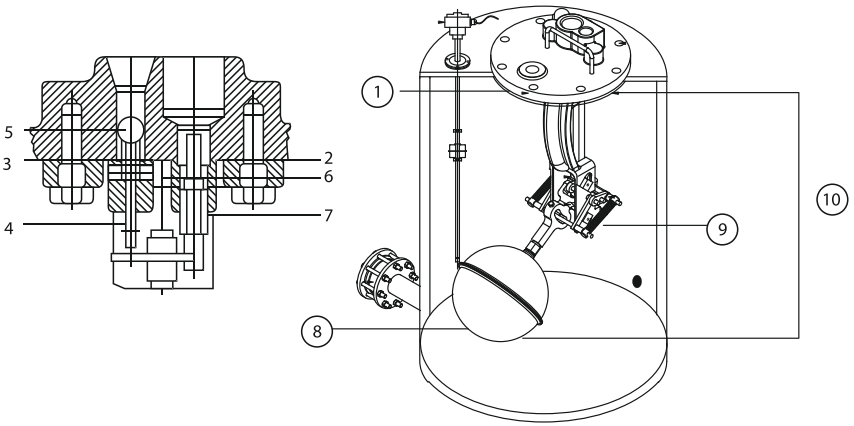


Figure 8: Available Spares for PPPPU-D

SPARES	PART NO.	SPARE CODES
SPARE KIT FOR PPPPU-D INTERNALS	10	S2001086
SPARE KIT FOR GASKET SET (SET OF 5)	1,2,3	S2001087
SPARE KIT FOR PPPPU-D INLET VALVE SEAT AND HEAD ASSEMBLY	4,5	S2001088
SPARE KIT FOR PPPPU-D EXHAUST VALVE SEAT AND HEAD ASSEMBLY	6,7	S2001089
FLOAT ASSEMBLY	8	S2001030
SPARE KIT FOR PPPPU-D SPRING ASSEMBLY(SET OF 2)	9	S2001046

How to Order:
Example : DN 80 Duplex Pressure Powered Pump Package Unit PPPPU-D

How to Order Spares:
Always order spares by using the description given in the column headed "Available Spares" in user manual for this product.

10 Warranty Period:

As per the ordering information and agreement in the contract

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Doc# FMSS/0415/UM-PPPPU-D/V1.R0

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